POINTING CONTROL vs. POINTING KNOWLEDGE

POINTING CONTROL

- TRUE SPACECRAFT/MODIS DIRECTION *wrt* DESIRED DIRECTION
- INCLUDES INSTRUMENT AND SPACECRAFT EFFECTS
- CONTROL IS NOT A CRITICAL PARAMETER FOR MODIS

POINTING KNOWLEDGE

- THE ERROR BAR ON CALCULATED POINTING
- CONSISTS OF STATIC AND DYNAMIC (RANDOM PLUS PERIODIC) ERRORS

PROPOSED MODIS POINTING KNOWLEDGE

300 ARC SEC FOR MODIS INSTRUMENT

	ROLL/SCAN ARCSEC (3σ)	PITCH/TRACK ARCSEC (3σ)	YAW ARCSEC (3σ)
DYNAMIC			
INSTRUMENT	45	24.9	30.2
SPACECRAFT	18.1	18.1	14.3
RSS	48.5 [165 m]	30.8 [105 m]	33.4 [114 m]
STATIC			
INSTRUMENT	300	300	300
SPACECRAFT	55.7 including 33.4 launch shift	67.8 including 29.3 launch shift	49.8 including 35.2 launch shift
RSS	305.1 [1043 m]	307.6 [1051 m]	304.1 [1038 m]
TOTAL DYNAMIC & STATIC	353.6 [1208 m]	338.4 [1157 m]	337.5 [1153 m]
OLD SPEC	141 [482 m]	141 [482 m]	141 [482 m]

MODIS POINTING KNOWLEDGE ALLOCATIONS
CURRENT ALLOCATIONS

From SBRC Memo PL3095-M05612, T. Pagano, 8 Feb 1996
& LMMS Alignment Plan, Oct 1995, p.28, Table 3

	ROLL/SCAN ARCSEC (3σ)	PITCH/TRACK ARCSEC (3σ)	YAW ARCSEC (3σ)
DYNAMIC			
INSTRUMENT	45	24.9	30.2
SPACECRAFT	18.1	18.1	14.3
RSS	48.5 [165 m]	30.8 [105 m]	33.4 [114 m]
STATIC			
INSTRUMENT	36.5	36.5	36.5
SPACECRAFT	55.7 including 33.4 launch shift	67.8 including 29.3 launch shift	49.8 including 35.2 launch shift
RSS	66.6 [227.6 m]	77.0 [263.2 m]	61.7 [210.9 m]
TOTAL DYNAMIC & STATIC	115.1 [393 M]	107.8 [368]	95.1 [325]
TOTAL SPEC	141 [482 m]	141 [482 m]	141 [482 m]

MODIS POINTING KNOWLEDGE TESTING

WITH 300 ARC SEC POINTING KNOWLEDGE REQUIREMENT

POINTING TESTING PRESERVED:

- POINTING DIRECTION WRT INSTRUMENT CUBE
  BEFORE & AFTER INSTRUMENT-LEVEL VIBRATION
- DURATION: ONE DAY BEFORE VIBRATION, ONE DAY FOLLOWING VIBRATION
- USING SIMPLIFIED PROCEDURE PC06/PC13

POINTING TESTING ELIMINATED:

- 6 - 8 DAYS OF CRITICAL PATH SCHEDULE SAVED (MORE IF PROBLEMS ARISE)
- 6^{+} CHECKS OF POINTING DURING I&T OF MAINFRAME
  (PROCEDURE PC06/PC13, NOT YET WRITTEN)
- REPEATED SHIMMING OF ROTARY TABLE, IAC, ETC
  AS REQUIRED TO ALIGN TEST EQUIPMENT & MODIS SCAN PLANE
- REPEATED TESTS AS NECESSARY TO EXPLAIN ANY CHANGES DETECTED
  PAST SYSTEM-LEVEL CHANGES WERE ALWAYS TRACED TO TEST GEAR

Geolocation

- Bias Test Comments
- Chris's Questions

Bias Test

- Dropping tests is a trade-off, science cost of post launch delay to provide reasonable geolocation vs prelaunch cost and schedule.
- There will be an impact in terms of time and confidence to get to accurate geolocation but it can be done.
- If necessary consider dropping the test but do NOT loosen the specification.

Update Accuracy Estimate

- Pagano will provide updated estimates for instrument pointing and registration this summer.
- We will get latest knowledge for platform attitude and tracking
- We will update the 1993 Geolocation Error Analysis by the next Team meeting

What is the planned activity

- Fred will (has) described general approach
- Ground control points with EDC
- Joint activity with ASTER and MISR
- Test data synthesized from TM by synthetic data crew
- Plan completed this summer (Fleig, Patt, Wolfe)

Timelines for Post Launch

- Requires several things to start
  - Attitude Control works to spec. /reprocessing
  - Tracking works to spec. /reprocessing
  - Our software works
  - Collection of control point matchups
- Time to eliminate bias is a function of what other errors are present. Probably 6 months.

People and Money

- Oversight-Fleig, GSC direction-Patt, coding-Blanchette, technical review-Wolfe, synthetic data-Fleig, Yang, Devine
- This is working
  - ATBD completed with external review
  - Bowtie discovered and described
  - Triangular weighting function and pixel overlap
  - Successful beta delivery

People and Money

- Coding and testing staff seems adequate
- Ground Control Point currently unfunded
  - Plan this summer
  - EDC involvement under discussion
  - Aster, MISR, MODIS all involved, discussions scheduled for June 10-14 at JPL

MODIS Geolocation Error Analysis and Reduction: A Brief Discussion

1. How Do We Check Geolocation?

   Ground Control Points
   Islands / Coastlines
   Matching and Correlation Algorithms
   Expected Accuracies

2. Representative Mission Examples

   COBE
   SMM
   AVHRR
   TM
   SeaWiFS

3. Confounding Issues

   $E = b$; or
   $E = at + b$; or
   $E = ae^{\alpha t} +$; or
   $E = ae^{\alpha t} + b + c\Gamma$

MODIS Post-Launch Geolocation Error Reduction Timeline